NOAA's National Weather Service
Milwaukee/Sullivan

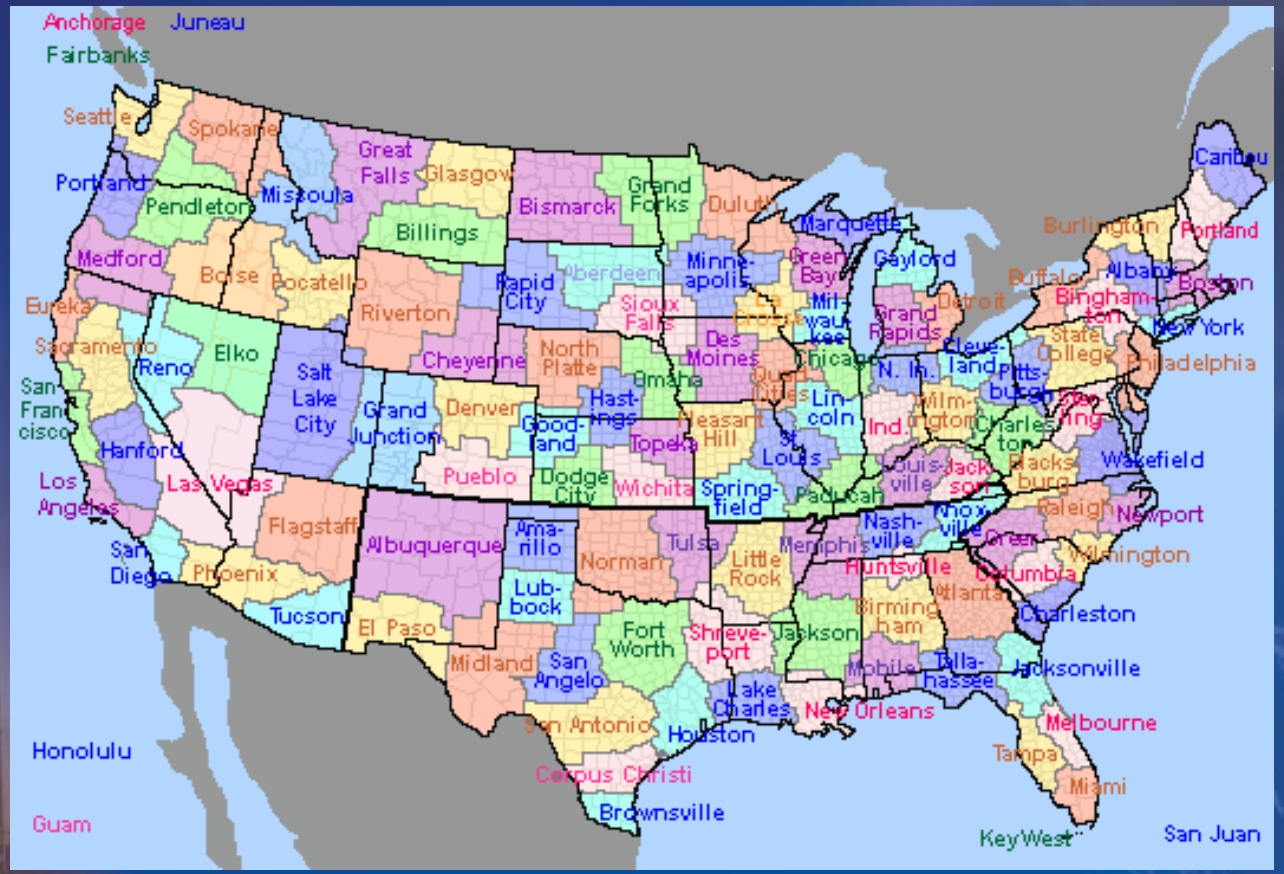
Weather Impacts on Aviation

Marcia Cronce
Meteorologist, Aviation Focal Point

April 2014 (Updated August 2014)

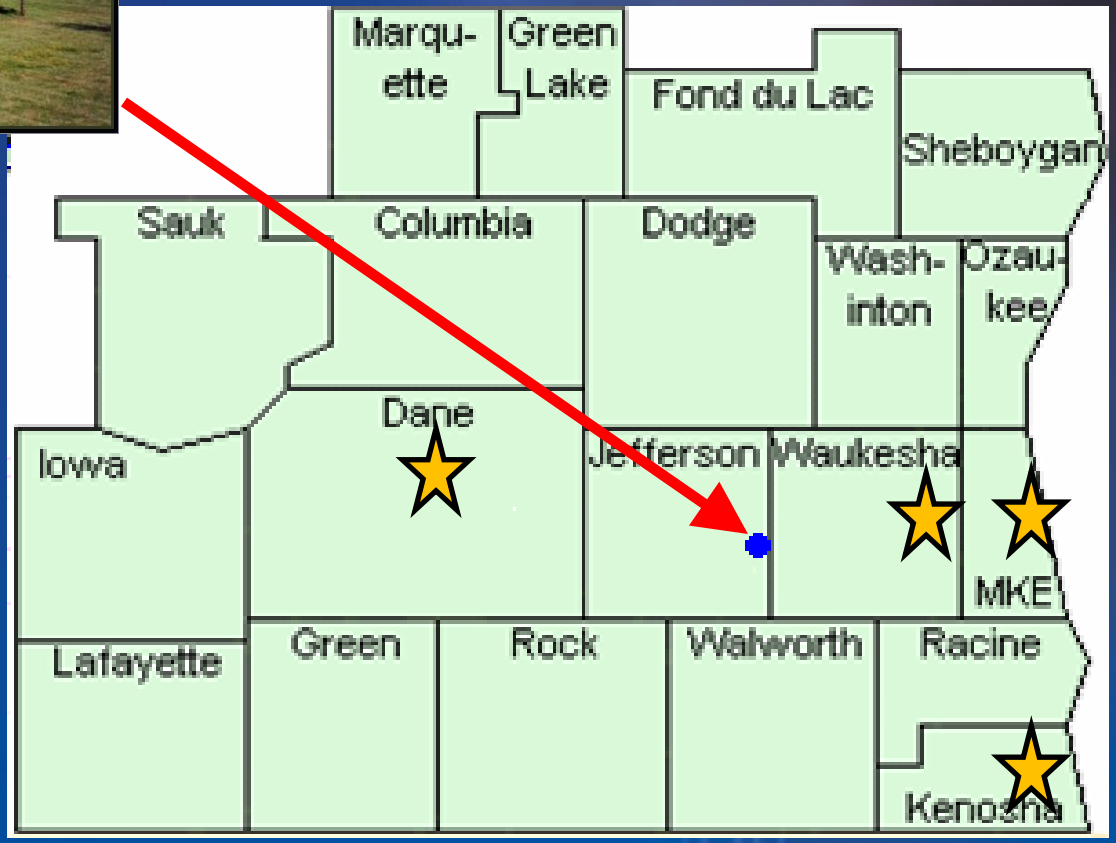
weather.gov/milwaukee

NWS: A Federal Government Agency



WFO Milwaukee/Sullivan Service Area

TAF Sites

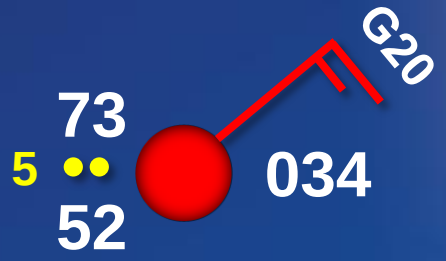


- Watch/Warning Responsibility
- 20 counties
- Southeast and South-Central Wisconsin.

The Tools We Use…

The Tools We Use…

Surface Obs and METARs

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    P0003=
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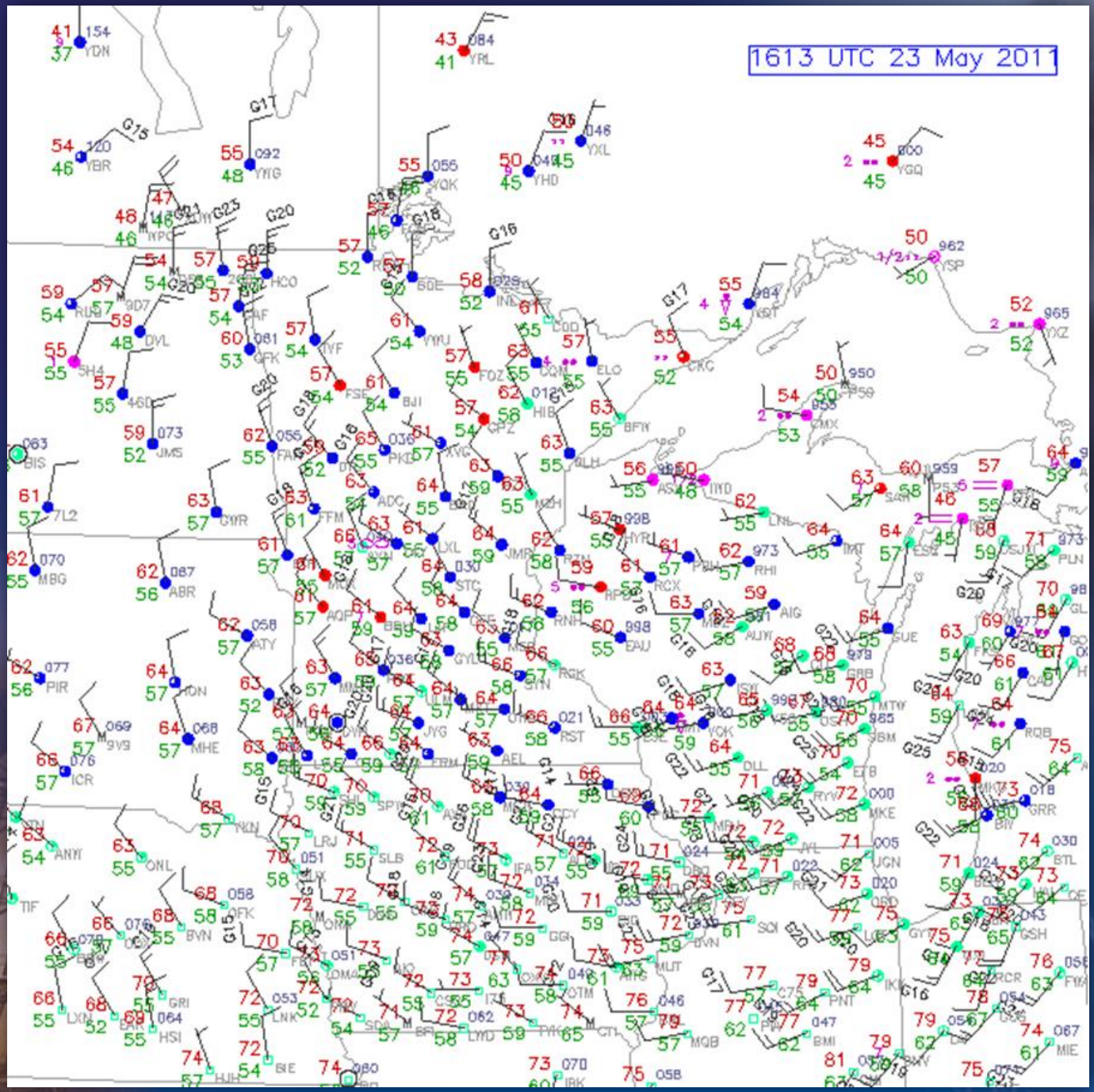

1613 UTC 23 May 2011

Webcams

Milwaukee-area current travel information - freeway camera images - Windows Internet Explorer

http://www.dot.wisconsin.gov/travel/milwaukee/cameras.htm

Milwaukee-area current travel information - freeway c...

WISCONSIN DEPARTMENT OF TRANSPORTATION

Travel Information

Drivers & Vehicles | Safety | Travel | Plans & Projects | State Patrol | Doing Business | Programs for Local Gov't

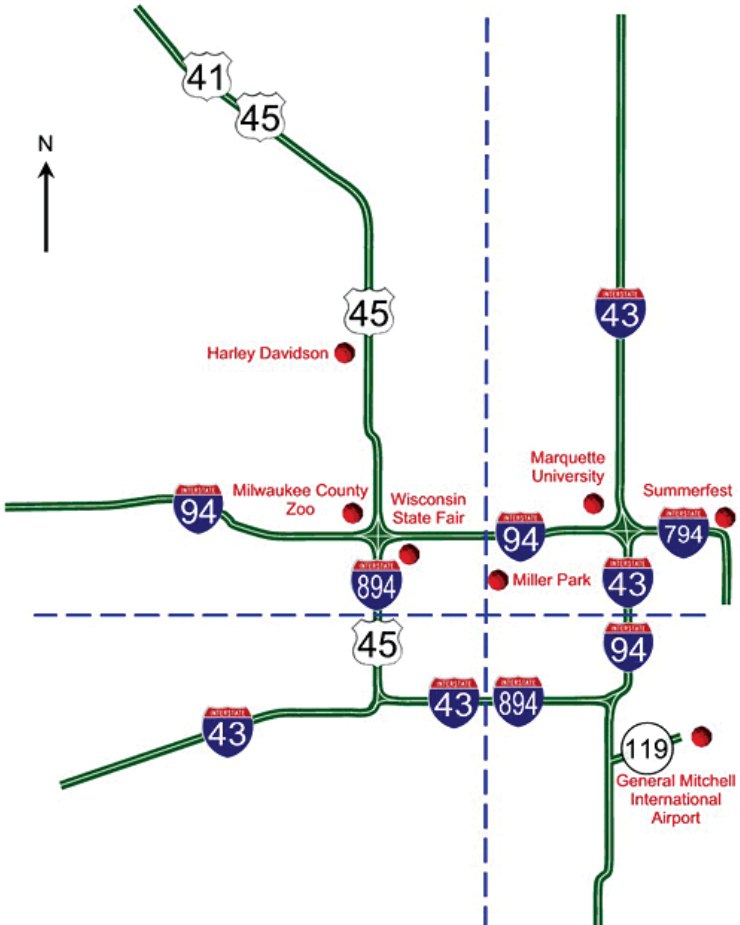
- Milwaukee-area current travel information
- Travel times
- Freeway camera images
- Lane and ramp closures
- Congestion maps

Travel > Travel by > Road > Milwaukee-area current travel info >

Milwaukee-area freeway camera images

Images from the Milwaukee area cameras are available to help travelers check freeway conditions. timestamp appears at the bottom of each camera image.

Select a quadrant below to view the current conditions.



Terminal Aerodrome Forecasts
TAFs

Terminal Aerodrome Forecasts (TAFs)

- TAF sites around the region
- 24- to 30-hour forecast
- 5-mile radius of site

- Forecast
  - *Wind direction, speed*
  - *Visibility*
  - *Weather*
  - *Ceiling Heights*

```
KUES 111801Z 1118/1218 05010G16KT 6SM HZ VCTS
SCT005 SCT040CB
   TEMPO 1118/1121 3SM -TSRA BR BKN040CB
FM112100 09007KT 6SM HZ VCTS SCT005 SCT040CB
   TEMPO 1121/1201 2SM TSRA SCT005 BKN030CB
FM120100 17005KT 5SM BR SCT035 BKN120
FM120600 23005KT 5SM BR SCT035 BKN120
FM121500 17005KT 6SM HZ BKN120=
```

Flight Categories Amendment Criteria

Ceiling / Visibility Thresholds	CAC Flight Categories
2000 thru 3000 ft and/or 3 thru 5 sm	MVFR
< 2000 ft and/or < 3 sm	Must File Alternate
< 1000 ft and/or < 3 sm	IFR
< 600 ft and/or < 2 sm	Alternate Landing Minimums
< 200 ft and/or < ½ sm	Airfield Landing Minimums

- We amend when we expect flight category to change
- LLWS (>20 KT within 2000 ft of ground), PIREPS help

TAF Hints

KMSN 240728Z 2407/2506 VRB06KT 3SM TSRA BR SCT015 OVC023CB

TEMPO 2408/2411 1SM +TSRA BKN015CB

FM241200 VRB05KT 3SM BR BKN007 OVC020

FM241500 14006KT 6SM BR SCT007 BKN015 OVC150

FM241700 20004KT P6SM BKN025

FM241900 26006KT P6SM BKN035 PROB30 2419/2423 5SM TSRA BKN025CB

FM250300 01004KT 6SM BR BKN070=

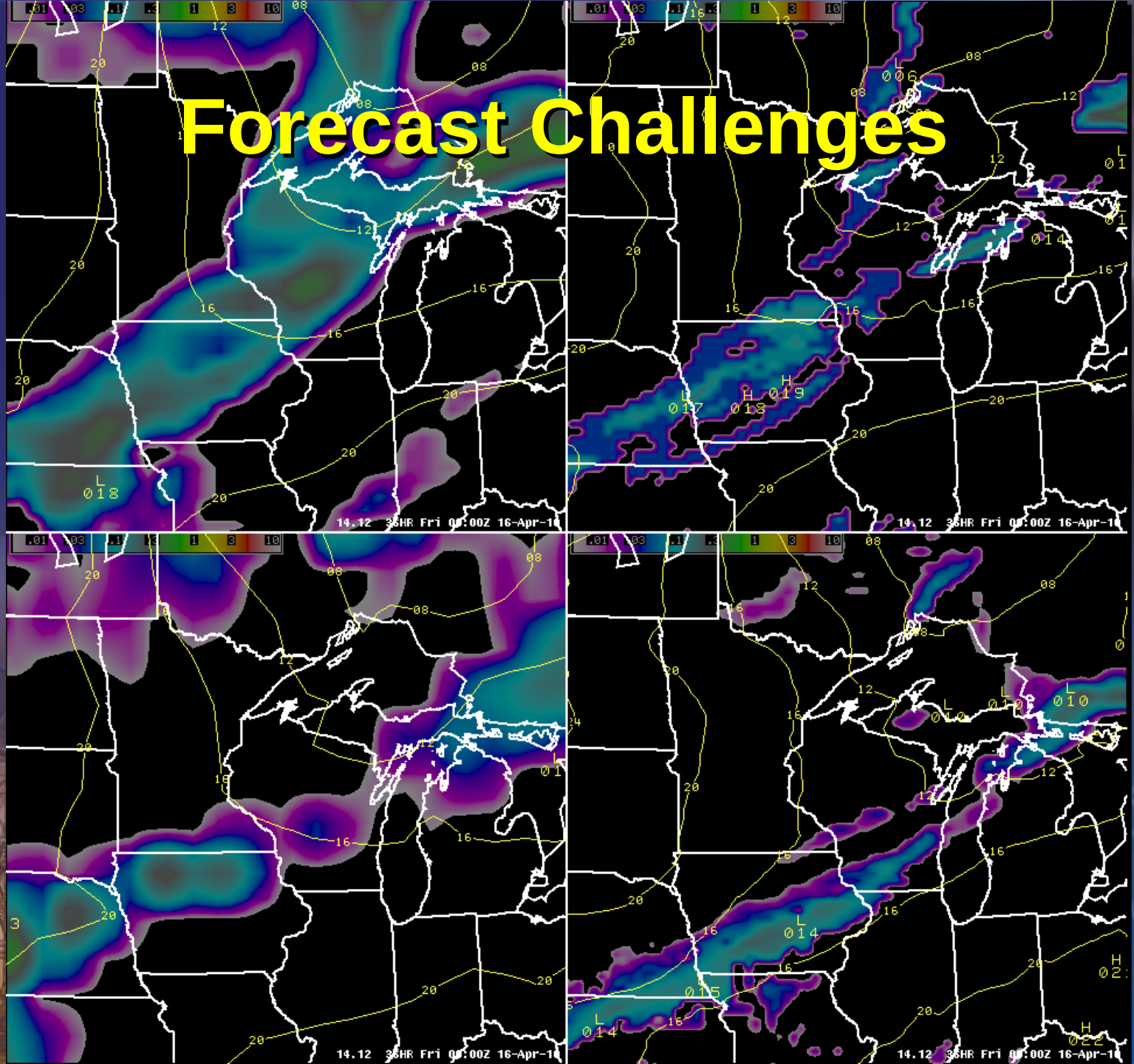
- A scattered group before a ceiling group may hint that ceilings could become lower
- 6SM visibility may hint that visibilities could be lower (MVFR)

Aviation Forecast Discussion

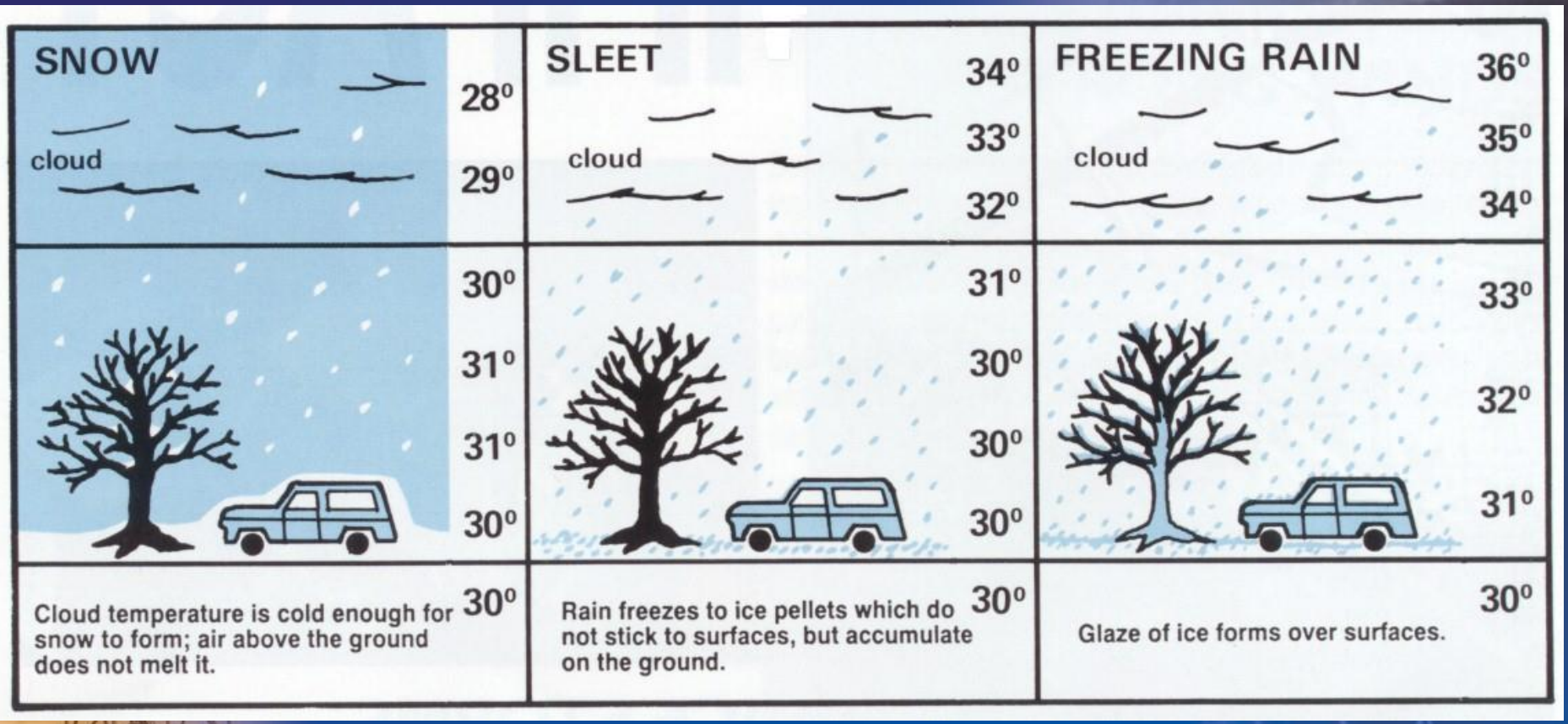
Found at bottom of Area Forecast Discussion (AFD)

.AVIATION...SOME LINGERING LOWER CLOUDS IN THE SOUTHEAST...MAINLY MVFR...SHOULD CLEAR OUT BY 12Z THIS MORNING. VFR THEREAFTER AS DRY AIR WORKS IN. ATMOSPHERE DESTABILIZES THIS AFTERNOON TO BRING A SMALL CHANCE FOR MAINLY AFTERNOON INTO EARLY EVENING SHOWERS AND THUNDERSTORMS. A WEAK MID LEVEL SHORTWAVE ARRIVING THIS AFTERNOON WILL ADD SOME DEEPER LIFT TO THE INSTABILITY. ANY SHOWERS WILL DIMINISH QUICKLY IN THE DIURNAL DOWNSWING THIS EVENING...WITH SKIES CLEARING OUT OVERNIGHT.

Forecast Challenges



What Kind of Precipitation?

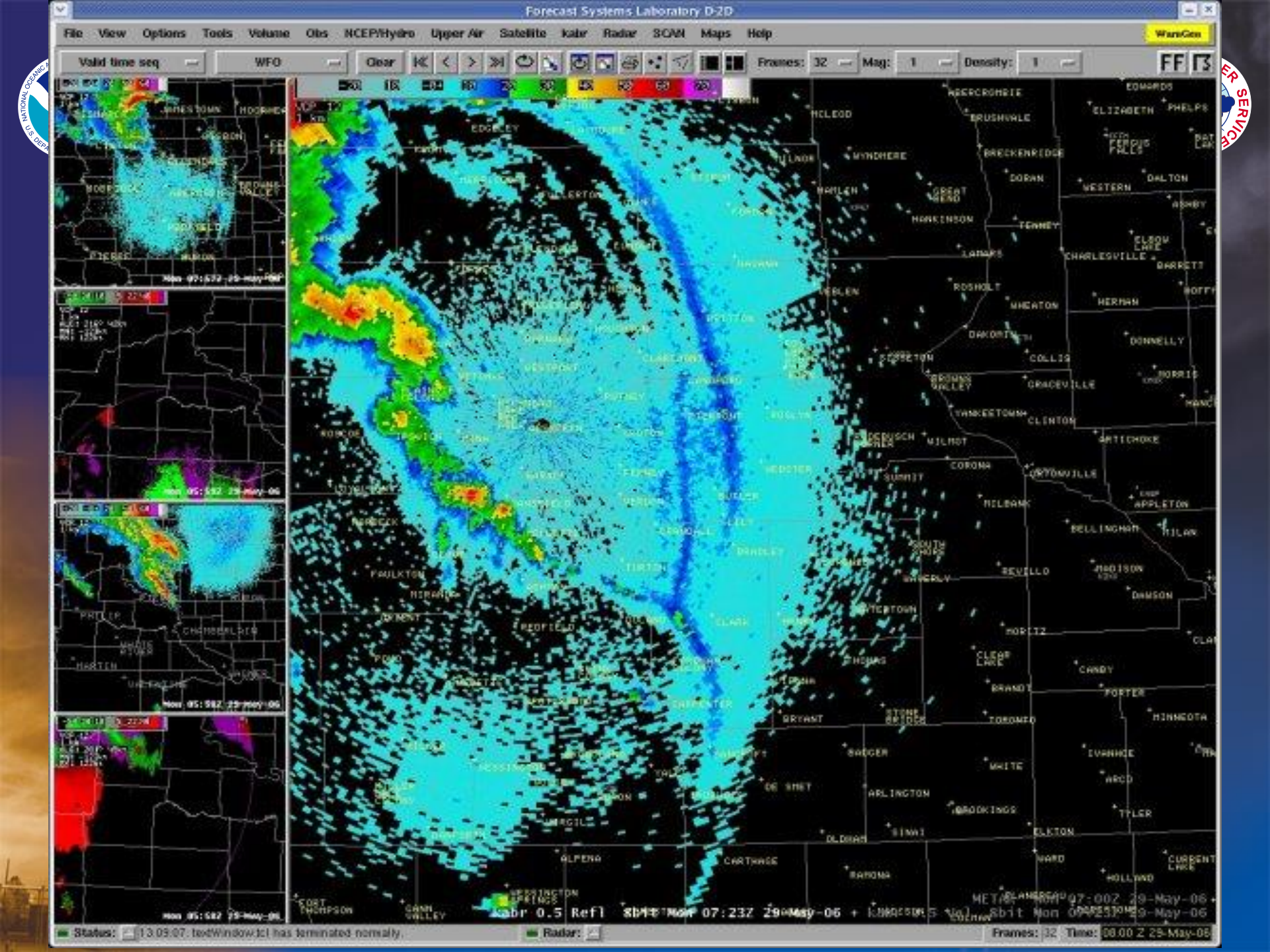


Convection Basics

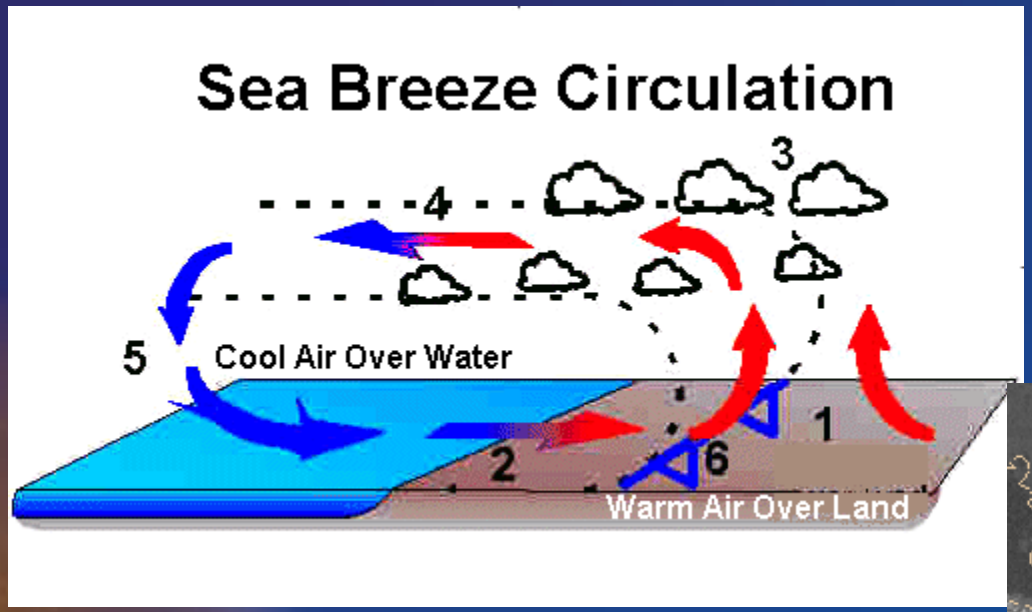
- Moisture
- Instability
- Lift
- Wind Shear (for severe storms)

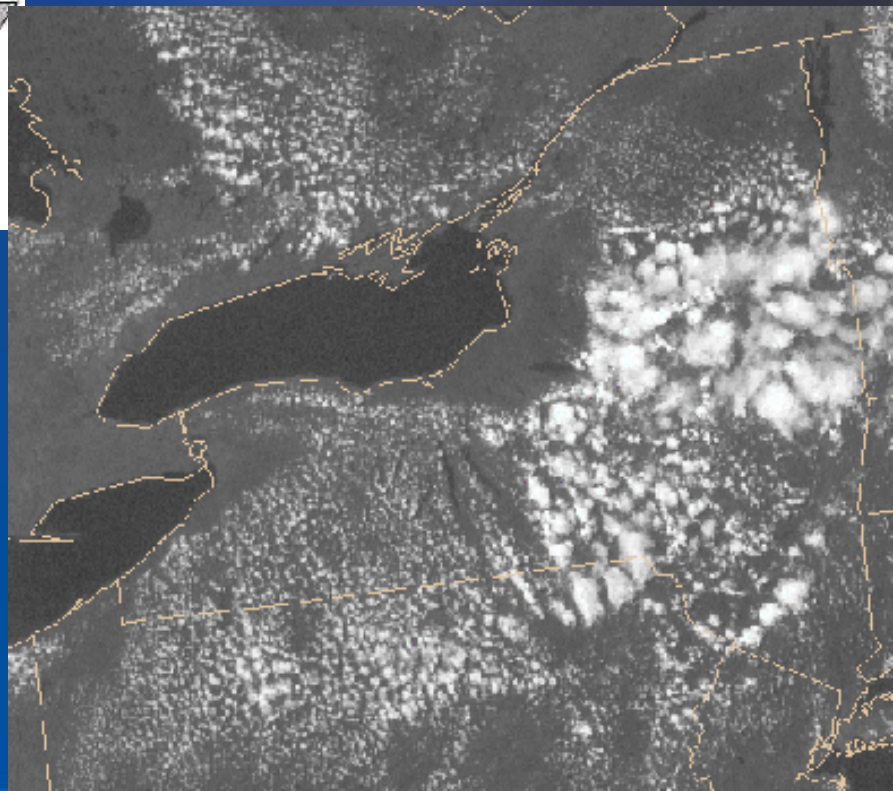
“Triggering” Mechanisms

- **Starts the convection**
  - *Low pressure systems*
  - *Air mass boundaries, Fronts*
  - *Sea/Lake Breeze*
  - *Thunderstorm ‘outflow boundaries’*
  - *Orographic lift*


Forecast Systems Laboratory D-2D
File View Options Tools Volume Obs NCEP/Hydro Upper Air Satellite kabr Radar SCAN Maps Help
WarnGen
Valid time seq
WFO
Clear
Frames: 32
Mag: 1
Density: 1
kabr 0.5 Refl
Status:
Radar:
Frames: 32
Time: 00:00 Z 29-May-06

Lake Breeze

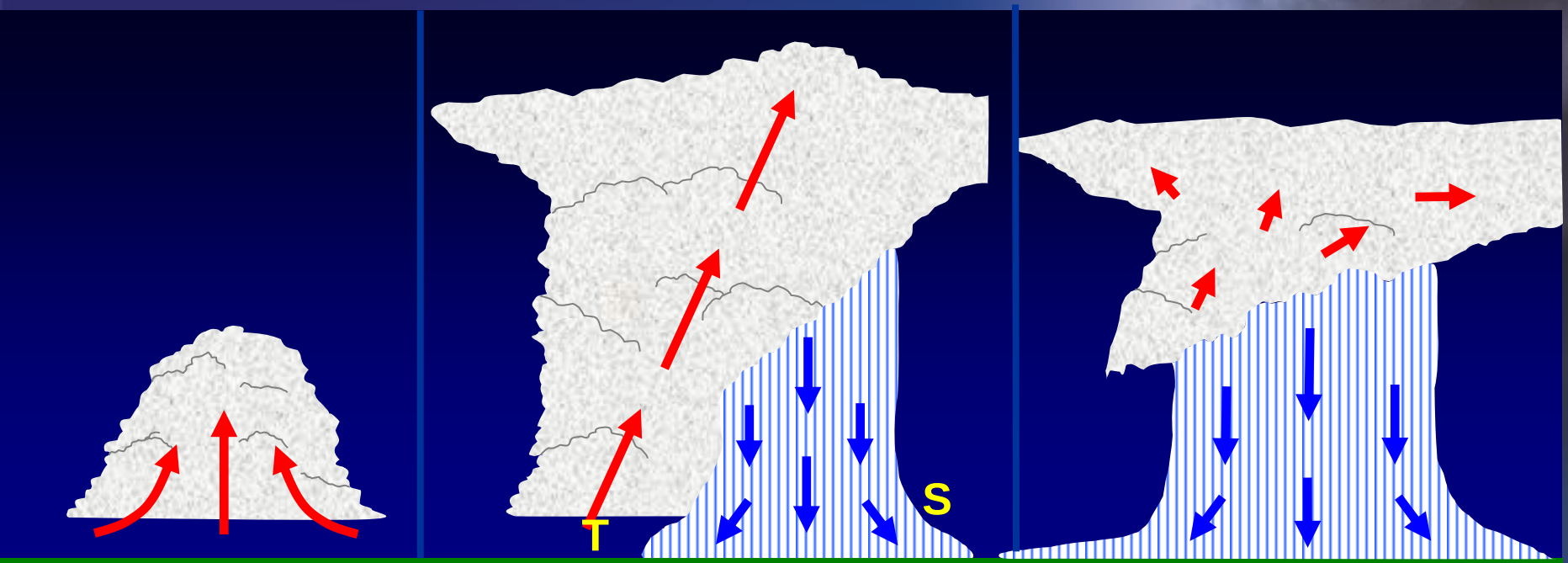

Sea Breeze Circulation
3
4
5
Cool Air Over Water
1
2
6
Warm Air Over Land



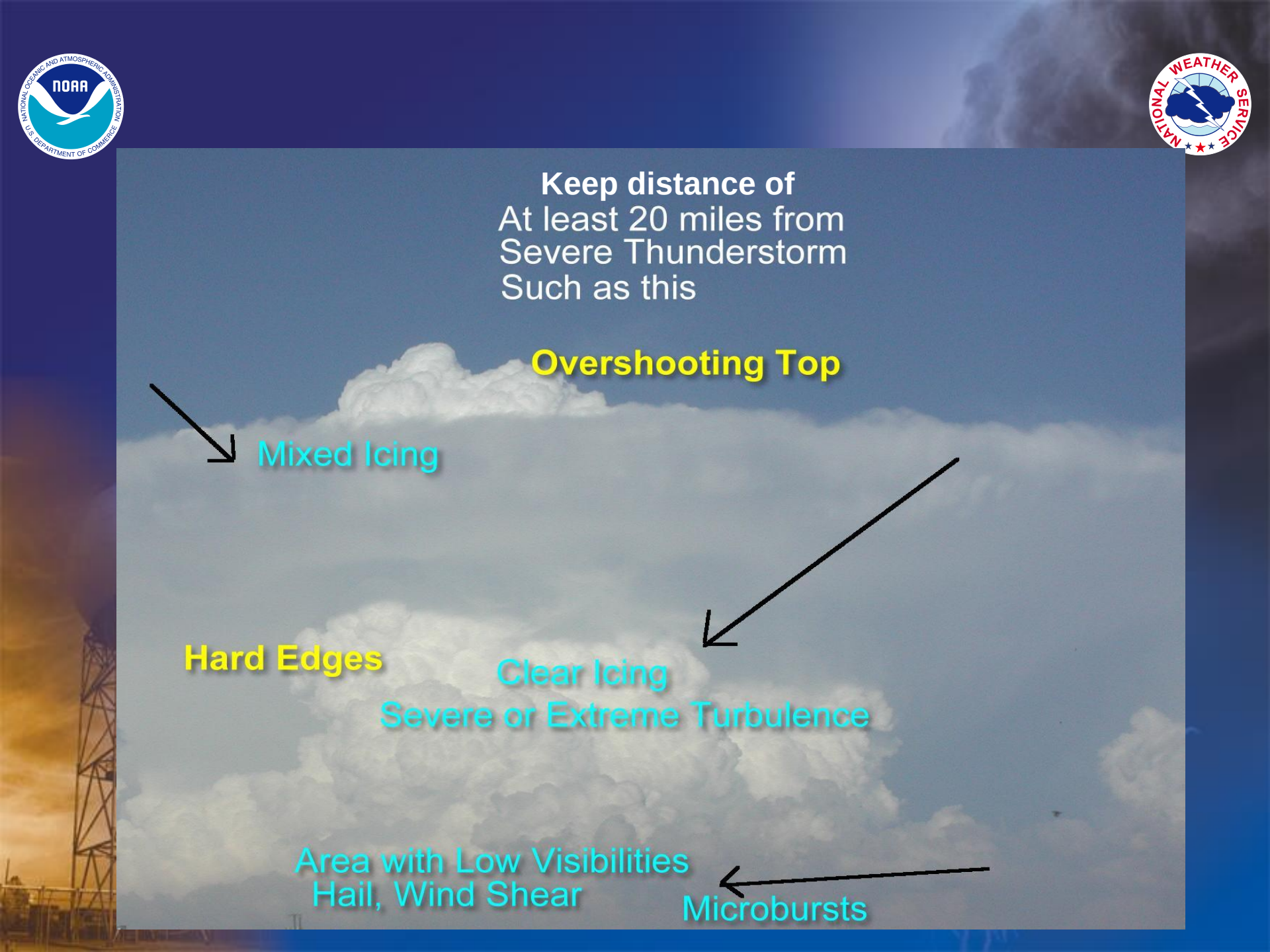
Four Types of Thunderstorms

Single Cell	Multicell Cluster	Multicell Line	Supercell
Weak updraft (non-severe or severe)	**Moderate updraft (non-severe or severe)**	**Moderate updraft (non-severe or severe)**	**Intense updraft (Always severe)** **Mesocyclone - Rotating updraft**
Slight threat	***Moderate threat***	***Moderate threat***	***High threat***
			

Thunderstorm Life Cycle



Cumulus Stage | Mature Stage | Dissipation Stage


Keep distance of
At least 20 miles from
Severe Thunderstorm
Such as this
Overshooting Top
Mixed Icing
Hard Edges
Clear Icing
Severe or Extreme Turbulence
Area with Low Visibilities
Hail, Wind Shear
Microbursts

Brief Icing Overview

Brief Icing Overview

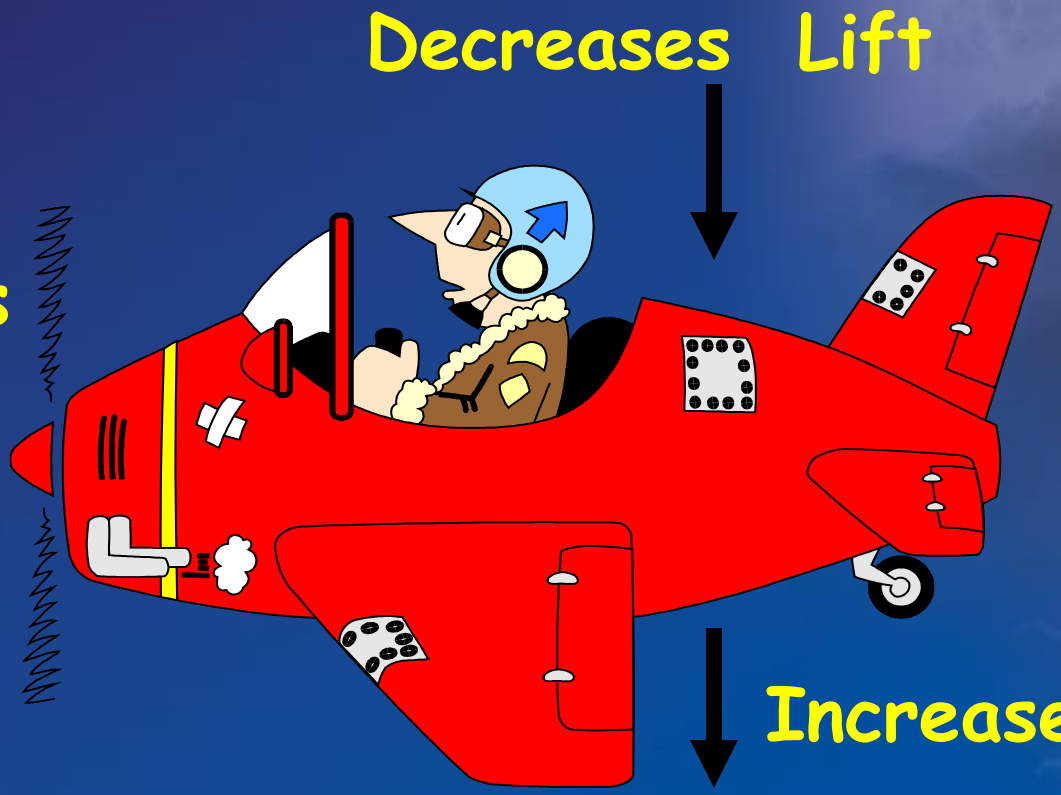
Types of Icing

- Rime (most common)
- Clear
- Mixed

Causes of Icing

- Supercooled Liquid Water Droplets
  - *Strike leading edge of airfoil*
  - *Freeze on impact*
- Residence time in cloud
- Forms 0°C to -20°C
- Common Temp -8 to -12C

Cumulative Affects of Icing



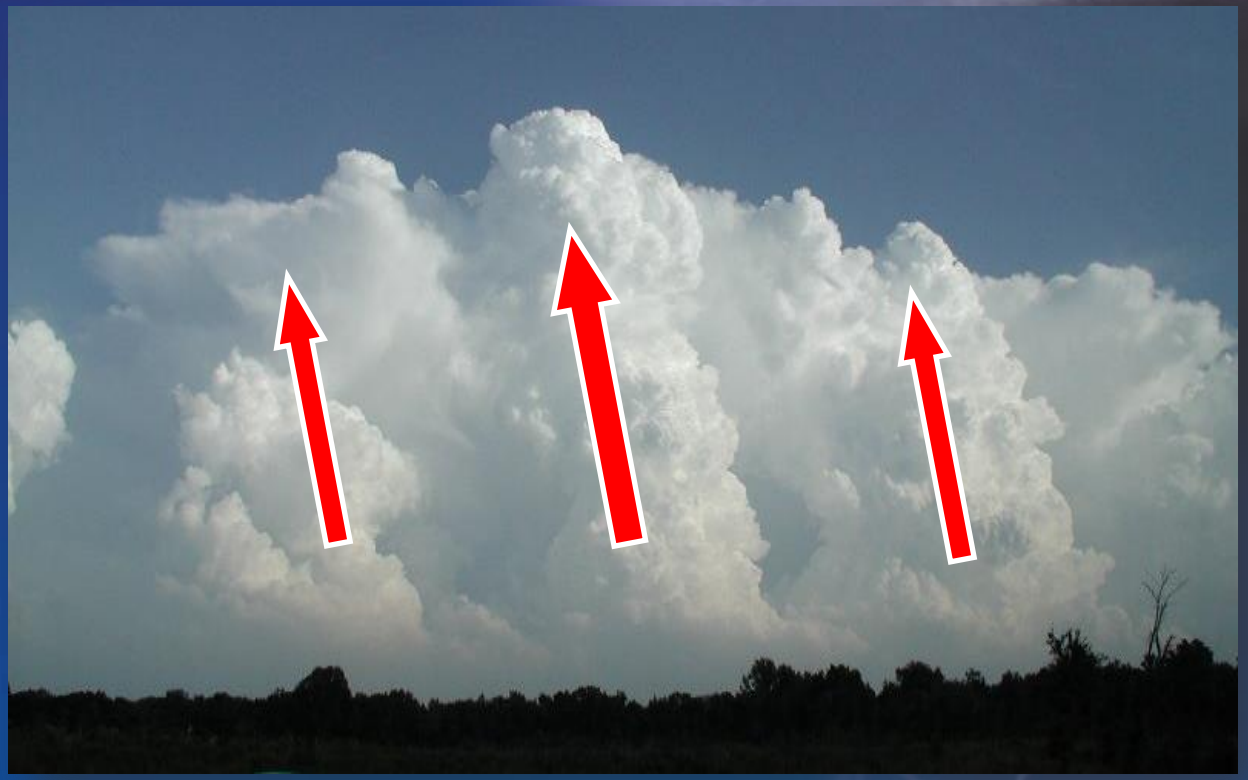
from Sally Pavlow, NWS Louisville

Lightning

Multi-Cell Thunderstorms

Ordinary, non-organized storms with low severe threat

Each cell lasts 20-30 minutes, but a cluster can last for hours



Heavy rain is the main problem

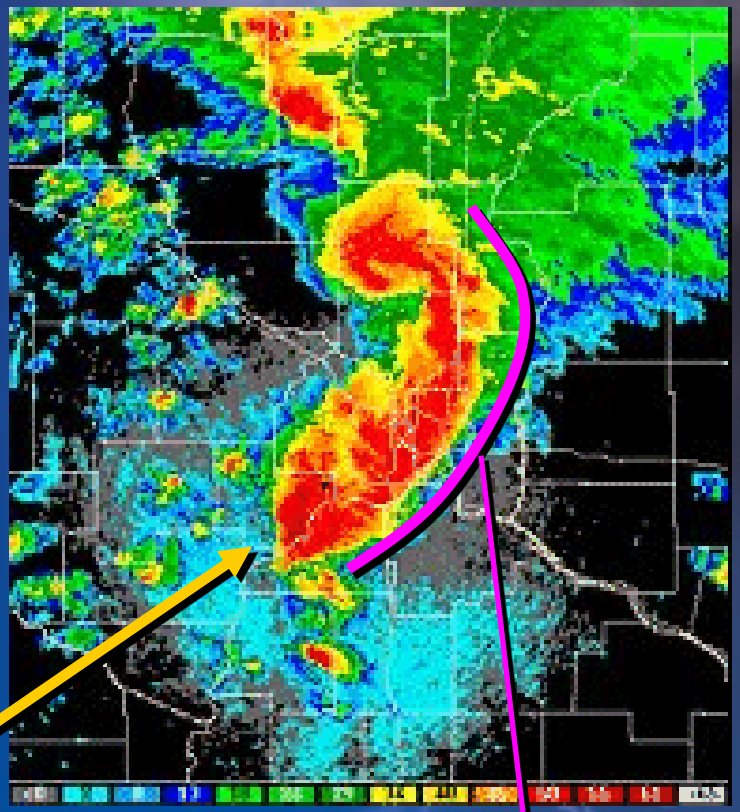
Strong winds, small hail and weak tornadoes are possible

Multi-Cell Thunderstorms

Ordinary, scattered storms with low severe threat

Squall Line - Bow Echo

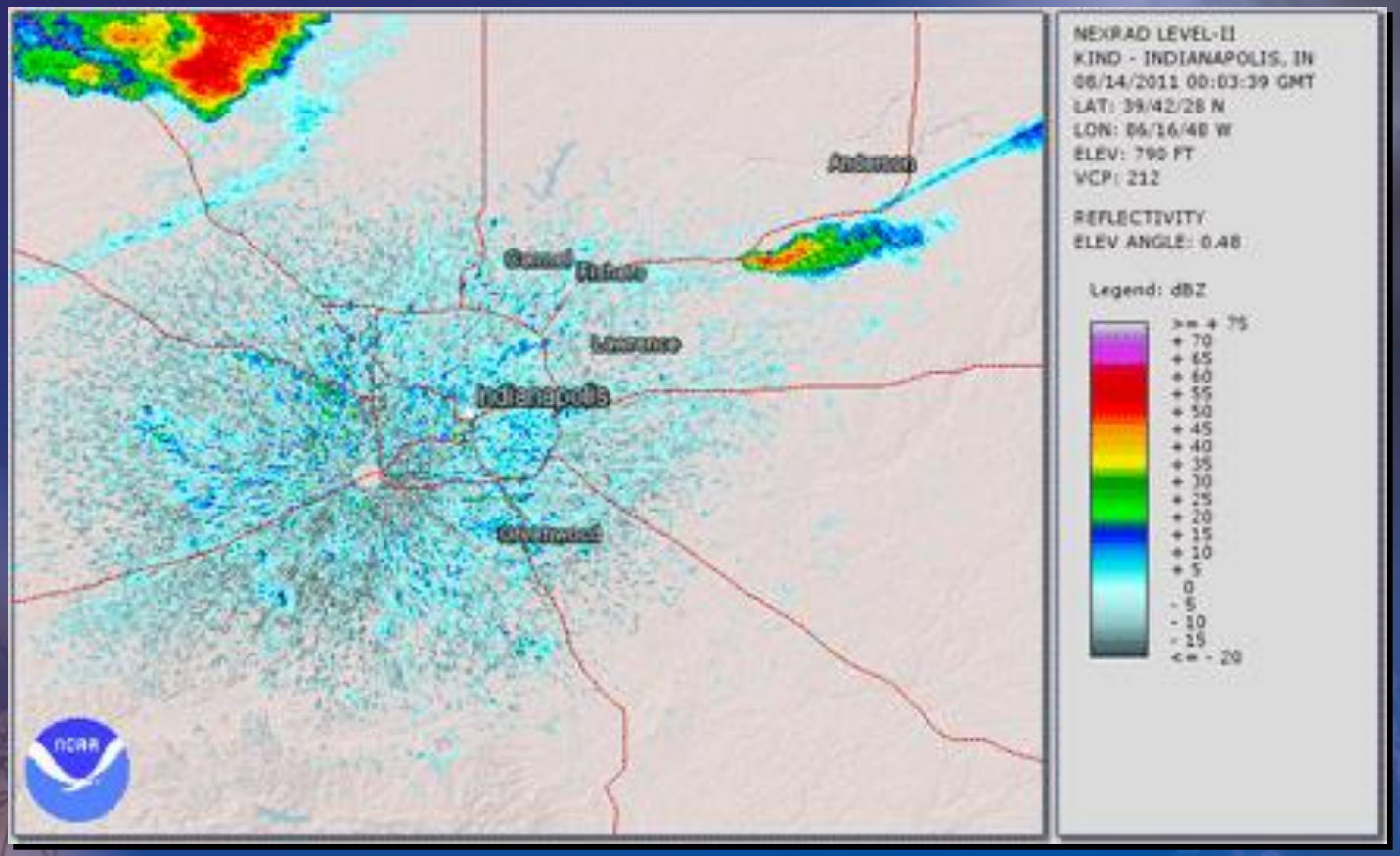
This shelf cloud is ahead of bow echo on right!



Storm moving left to right (W-E)

Well-developed shelf cloud is found on front side of line

8-13-2011 Indy State Fair

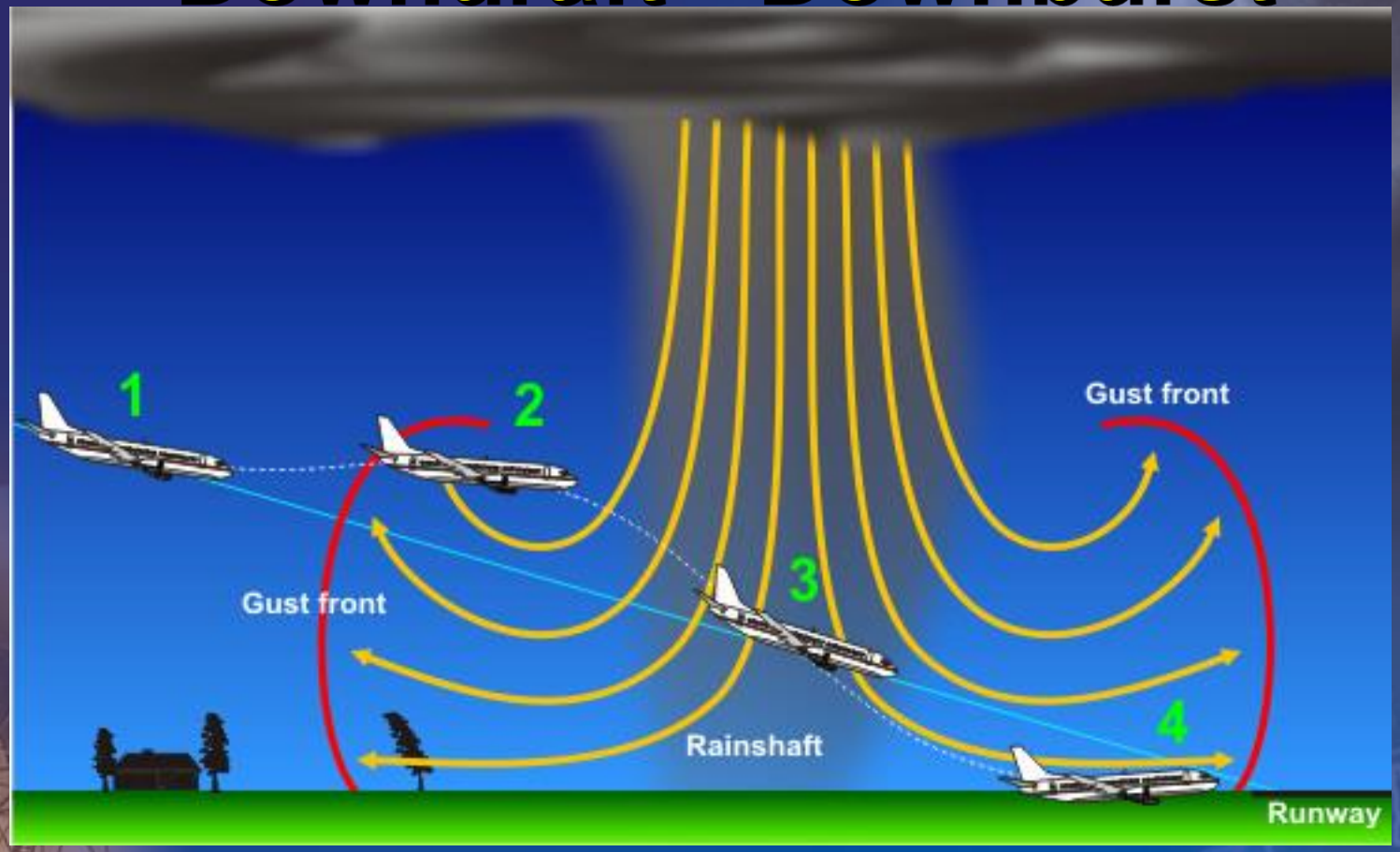


Straight-lined winds on leading edge of squall line
7 Fatalities, 43 injured, Estimated Wind Gusts 70 mph

Hail Shaft

Hail Damage

Downdraft - Downburst

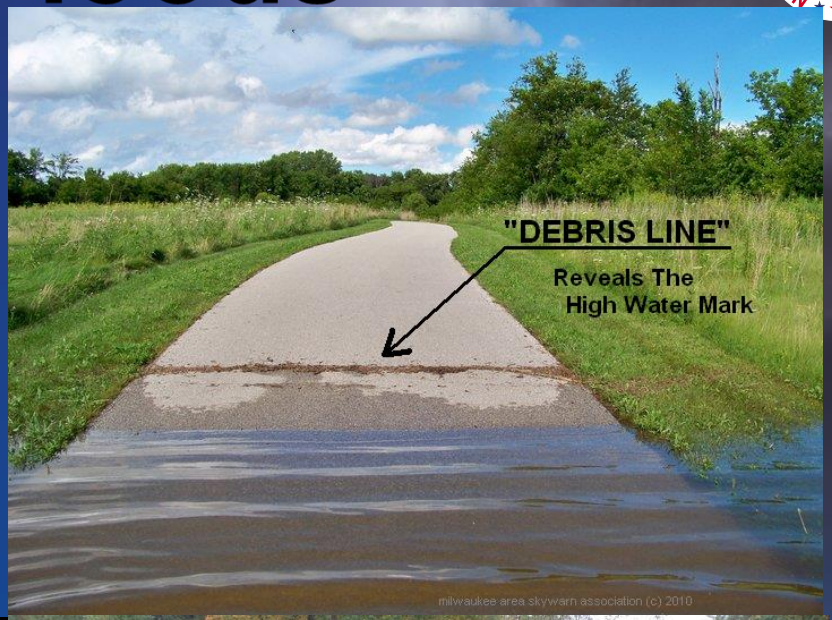


Gust Front - is leading edge of downdraft/ downburst, you don't see it but you do feel it as winds pick up and temperatures drop and then rain/hail start.

Flash Floods

NIGHT TIME FLOODING:
Judging Water Depth Can Be Difficult

Turn Around - Don't Drown



ABOVE THE ROAD

BELOW THE ROAD

AVOID

DIRT ROADS AT LOW WATER CROSSINGS

CREVASSES BELOW THE WATER ARE NOT SEEN UNTIL AFTER THE FLOOD WATERS HAVE DRAINED AWAY

mke-skywarn.org

Rotation in Updraft Tower

Spiral bands and cork-screw look

Rotating Wall Clouds

An isolated lowering of the rain-free base, rotating on a vertical axis

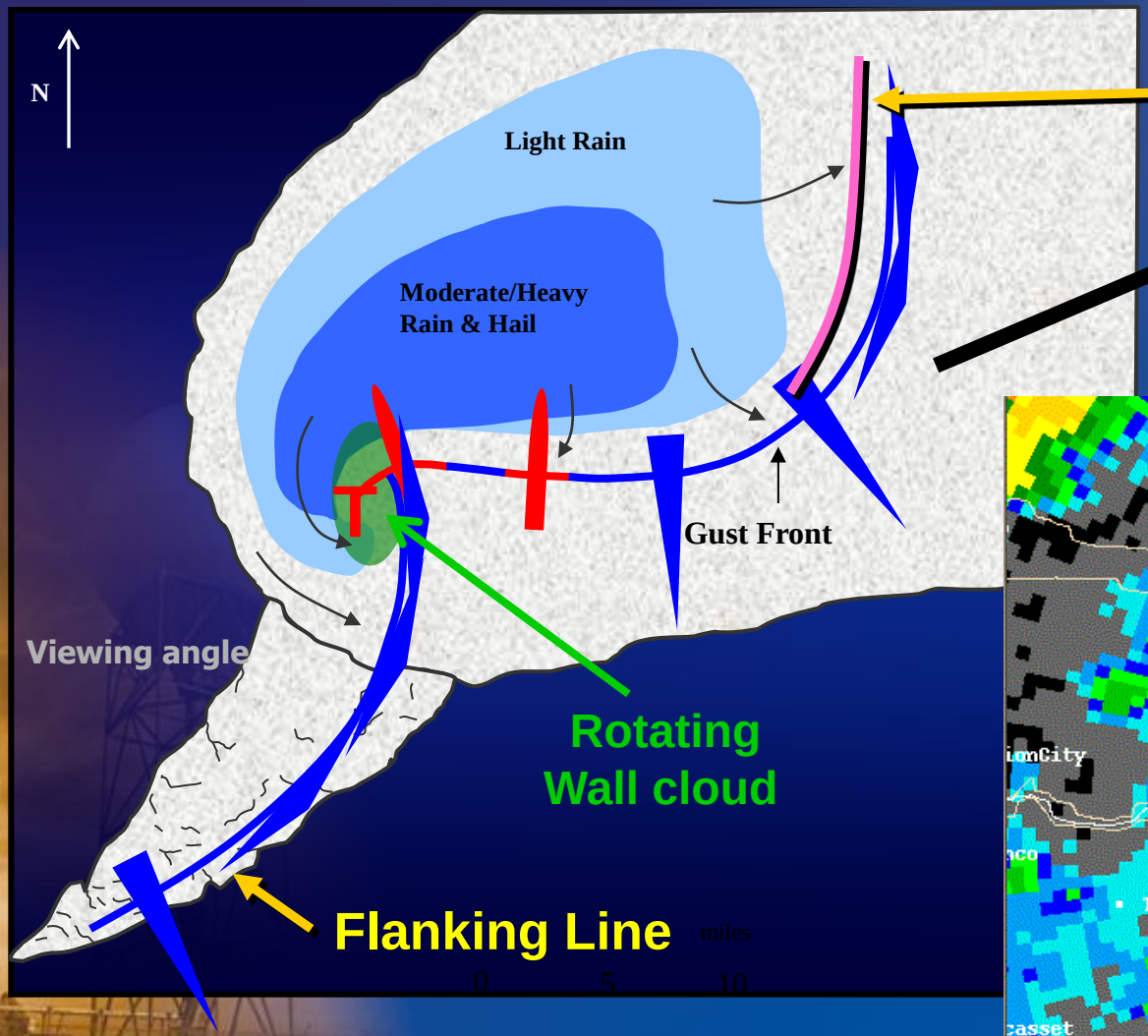
A good number of, but not all, tornadoes develop underneath or near a rotating wall cloud

Funnel Clouds

Tornado

Tornadic Supercell Thunderstorm

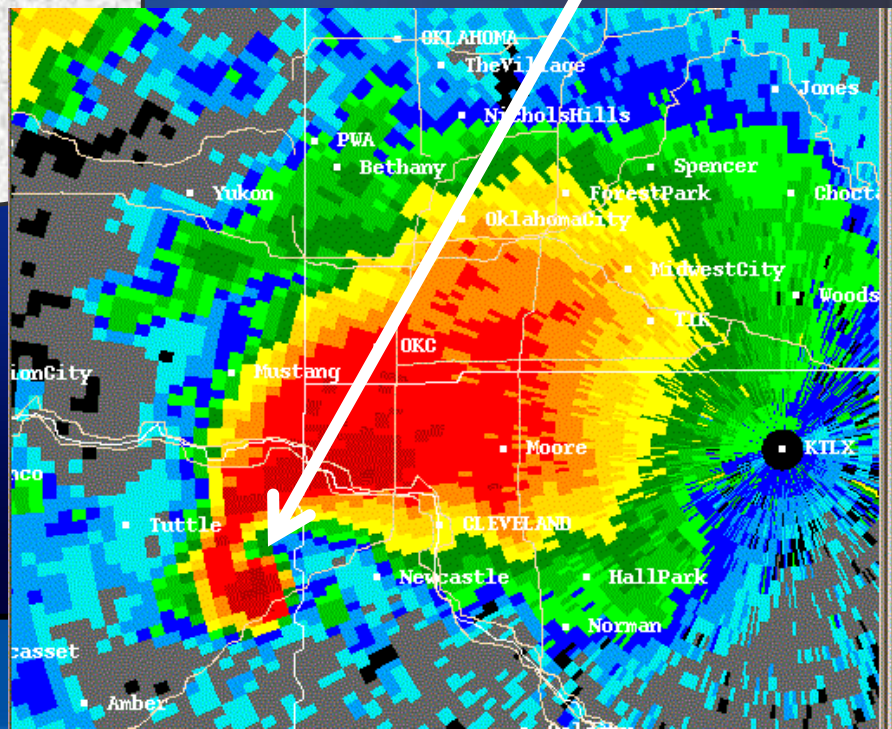
top-down view



Shelf Cloud

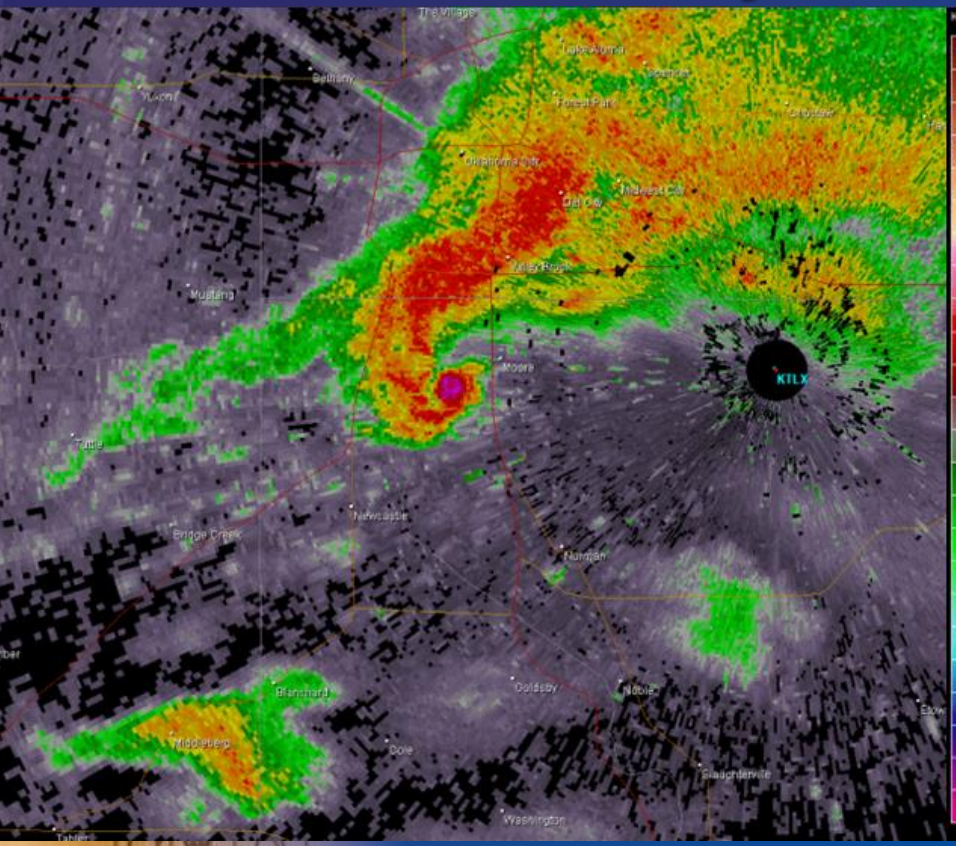
Storm motion

Hook Echo (tornado found in rain-free area within hook)

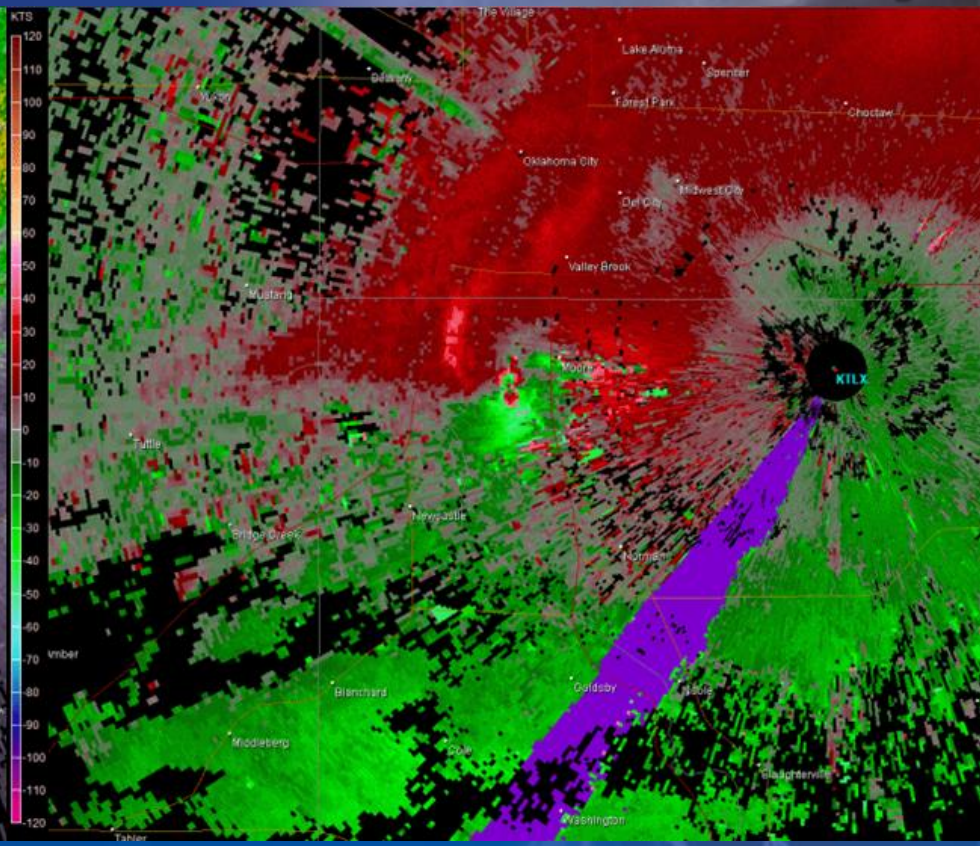


Radar Loops

Base Reflectivity



Storm Relative Velocity



May 20, 2013 Moore, OK

Wisconsin Tornadoes 1950-2011

Credit: Doug Norgord, Geographic Techniques

Personal Safety

This was a weak tornado – what about a strong or violent tornado?

Any Questions?

- Marcia.Cronce@noaa.gov